EXHIBIT 20

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Claim 1	Accused Advanced Antenna Mobile Devices[1]
[1PRE] A method for avoiding radiation of a user or structure by a wireless device having at least one steerable antenna, comprising the steps of:	The Accused Advanced Antenna Mobile Devices, such as smartphones and tablets (including but not limited to Galaxy S20-S25 models, Galaxy Z Flip 3-6 models, Galaxy Fold 3-6 models, and Galaxy Note 20 model smartphones), (i) are wireless devices, (ii) perform the claimed method as described in this table, and (iii) having at least one steerable antenna. The Accused Advanced Antenna Mobile Devices are wireless devices at least because they communicate via 5G cellular networks. The at least one steerable antenna includes an antenna array that consists of multiple individual antenna elements arranged in a specific geometric pattern. Each element radiates a signal, and the combination of these signals forms the overall radiation pattern of the array. Beam steering is achieved by controlling the phase of the signals fed to each individual antenna element in the array. According to an Operational Description for an Accused mmWave Product, the Accused mmWave Product includes a "mmW Antenna Module," which includes "two separate phased array chips (S5640)." Each phase array chip includes 20 antenna ports: 10 for 28 GHz band and 10 for 39 GHZ band.

[1] Upon information and belief, all Accused Advanced Antenna Mobile Devices function in a substantially similar manner for the relevant accused functionality.

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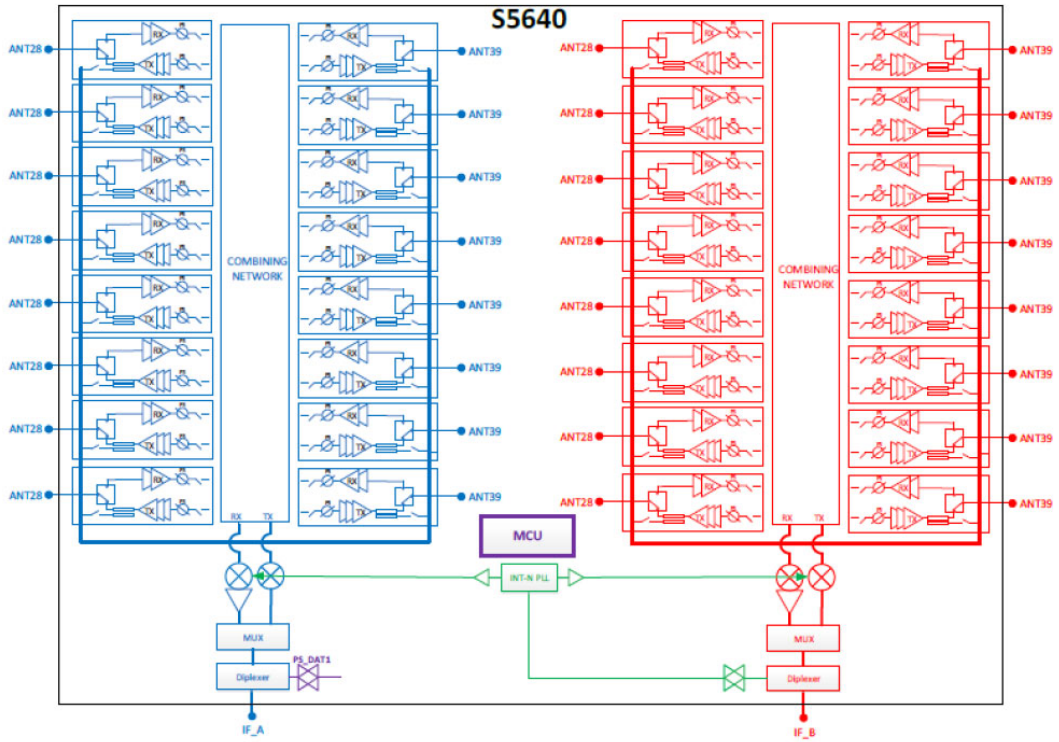

See fccid.io/A3LSMA536V/Operational-Description/A3LSMA536V-Operational-Description-Main-Part-R4-5651659.pdf ("Operational Description").

A teardown of a Galaxy S20 Ultra describes that this Accused mmWave Product includes "two Qualcomm RF ICs … w/multilayer package substrate antenna array …" *See* electronics360.globalspec.com/article/15093/teardown-samsung-galaxy-s20-ultra-5g

The "Criticality of 5G Modem to RF Integration; A look inside Samsung Galaxy S20 Ultra" article (https://omdia.tech.informa.com/om006104/criticality-of-5g-modem-to-rf-integration-a-

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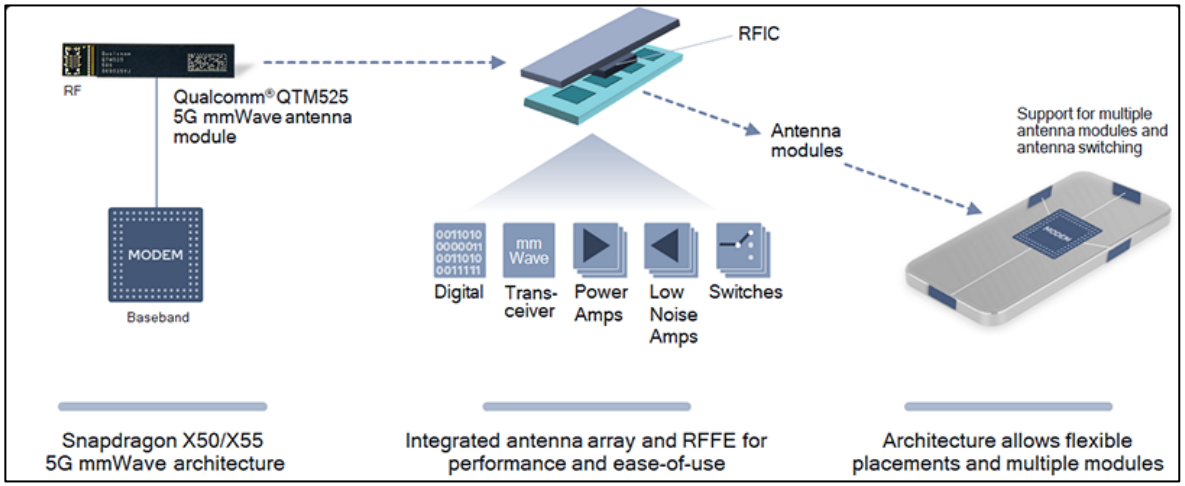
look-inside-samsung-galaxy-s20-ultra) describes a teardown of the S20 Ultra, including that the Qualcomm RF ICs in the Galaxy S20 Ultra are QTM525 mmWave Antenna modules.

The Qualcomm article "5G Modems, RF and Antennas — Getting mmWave Data into the Device describes the QTM525 mmWave antenna module as including an "array of tiny mmWave antenna elements …." *See* www.qualcomm.com/developer/blog/2019/11/5g-modems-rf-and-antennas-getting-mmwave-data-device

The Qualcomm article further describes the QTM525 mmWave antenna module, in communication with the 5G modems (e.g., Snapdragon X50, X55, X60), as capable of beamforming and beam tracking to avoid obstructions.

> mmWave technology works well in cities, where you can locate a small cell on top of a building and serve an entire block. In a dense, urban environment, the buildings would normally be an obstruction. But beamforming and beam tracking take advantage of them as an endless series of surfaces off of which the mmWaves can bounce.
>
> On the device, multiple mmWave antenna modules like the QTM052 and QTM525 are located in different places, as shown in the image below. The baseband modem switches among the antenna modules, depending on the source of the strongest signal. All of that takes place in real time in fractions of a millisecond.

See *Id.*



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	See *Id.*
[1A] detecting in a three dimensional space, using one or more cameras, microphones, audio sensors, ultrasound sensors or transducers, range finders, capacitive sensors, gyroscopes, light detectors, or motion detectors, an orientation of said wireless device relative to either or both said user and said structure;	The Accused Advanced Antenna Mobile Devices include, among other things, proximity sensors for sensing proximity of an obstacle, such as a user body part, to the wireless device, and also for detecting an orientation of the wireless device. The sensor(s) used to detect the orientation of the device, such as proximity to an obstruction, include, but are not limited to, (i) a range finder embodied, in whole or in part, by the modem and RF front-end system of the Accused Advanced Antenna Mobile Devices, including the phased array module and associated transceiver, (ii) one or more capacitive sensors, (iii) one or more light detectors, and/or (iv) one or more gyroscopes. For example, the Accused Advanced Antenna Mobile Devices include infrared sources and detectors. Infrared is a form of light energy, so the Accused Advanced Antenna Mobile Devices include at least light detectors for sensing an orientation of the obstacle relative to the wireless device. *See* www.samsung.com/ph/support/mobile-devices/what-is-this-proximity-sensor-on-your-samsung-smartphone. **How does the proximity sensor work?** A proximity sensor consists of a light-emitting and light-receiving component. Infrared rays from the light-emitting component analyze the light reflected from physical objects and measure the distance between the object and the device. The proximity sensor is installed under the display, on all the latest Galaxy smartphones and is now capable of detecting the angle of the device. Make a call and bring the phone close to your ear. The screen will turn off as you move the phone away, and the screen will wake up. The Accused Advanced Antenna Mobile Devices also include one or more gyroscopes that enable them to perform orientation detection. For example, the "Samsung Galaxy S21 Ultra Teardown" and "Samsung Galaxy S22 Chip ID" articles describe ASICs used in the Samsung Galaxy S21 Ultra and S22 Ultra, including the STMicroelectronics LSM6DSO. The STMicroelectronics LSM6DSO is 3-axis accelerometer/gyroscope combination chip. *See* https://www.ifixit.com/Guide/Samsung+Galaxy+S22+Chip+ID/148072; https://www.ifixit.com/Teardown/Samsung+Galaxy+S21+Ultra+Teardown/141188. The Accused Advanced Antenna Mobile Devices detect, using the proximity sensors, an orientation of the wireless device relative to, for example, body parts of the user. *See* www.samsung.com/ph/support/mobile-devices/what-is-this-proximity-sensor-on-your-samsung-smartphone.

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	For example, the Accused Advanced Antenna Mobile Devices include accelerometers, capacitive sensors, gyroscopes, and proximity sensors in the form of ambient light sensors and/or infrared light sensor that can detect the presence of the user. The Accused Advanced Antenna Mobile Devices use one or more of these sensors to detect the location that the user of the Accused Advanced Antenna Mobile Devices is gripping the device. The sensors are located near antenna patch of the antenna arrays so that the corresponding antenna patch can be deactivated to avoid the user. In another example, the Operational Description describes a grip sensor configuration that determines the presence and location of the user with a smart capacitive sensor. **1.11 Grip Sensor : SX9380** **1.11.1 General Description** The SX9380 is a smart capacitive sensor for SAR (Specific Absorption Rate). The resulting detection is used in portable electronic devices to reduce and control radio-frequency (RF) emission power in the presence of a human body, enabling significant performance advantages for manufacturers of electronic devices with electro-magnetic radiation sources to meet stringent emission regulations' criteria and Specific Absorption Rate (SAR) standards. *See* fccid.io/A3LSMA536V/Operational-Description/A3LSMA536V-Operational-Description-Main-Part-R4-5651659.pdf ("Operational Description").
[1B] determining zones or spans of directions in the three dimensional space corresponding with one or more directions of either or both said user and said structure relative to said at least one steerable antenna; and	The Accused Advanced Antenna Mobile Devices include, determine zones or spans of directions in the three-dimensional space corresponding with one or more directions of either or both said user and said structure relative to said at least one steerable antenna. For example, the Accused Advanced Antenna Mobile Devices determines an area or location associated with an obstruction and deactivates a corresponding antenna in the antenna array. For example, the Accused Advanced Antenna Mobile Devices use one or more sensors to detect the

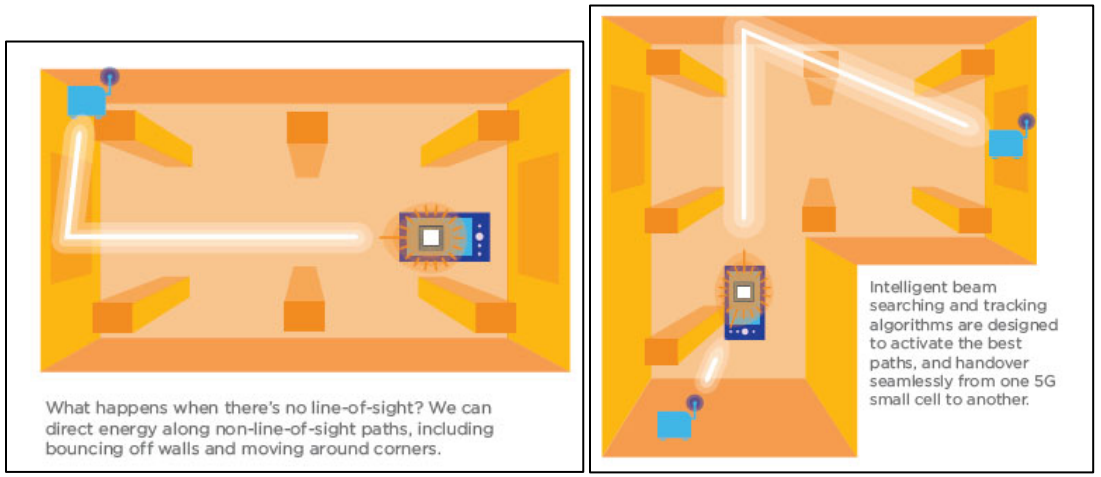
location that the user of the Accused Advanced Antenna Mobile Devices is gripping the device and deactivates the corresponding antenna to avoid the user.

In another example, the Accused Advanced Antenna Mobile Devices can determine transmission areas associated with beams that are associated with high and low signal attenuation.

The Qualcomm article "5G Modems, RF and Antennas — Getting mmWave Data into the Device describes the QTM525 mmWave antenna module, included in certain Accused Advanced Antenna Mobile Devices, that allows "[t]he device and the network exchange information constantly, directing beams in a way they can best reach each other."

See www.qualcomm.com/developer/blog/2019/11/5g-modems-rf-and-antennas-getting-mmwave-data-device

The images below, from the Qualcomm document, shows that the Snapdragon X50 5G modem can perform beamsteering to avoid obstructions when direct line of sight transmission paths are not available.



See https://www.qualcomm.com/content/dam/qcomm-martech/dm-assets/documents/x50info11.pdf

See claim elements [1PRE] and [1A] above.

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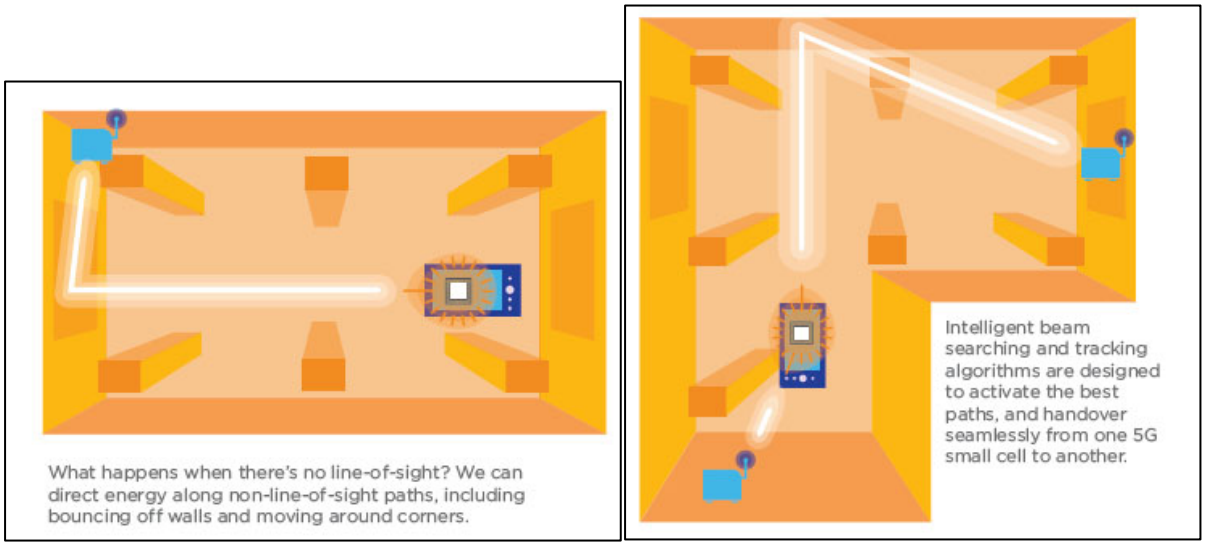
[1C] adjusting one or more beam radiation patterns of said at least one steerable antenna to radiate in one or more directions which are not in said zones or spans of directions in the three dimensional space, wherein said at least one steerable antenna is configured to steer or direct its energy in particular directions while providing nulls or dead zones in other directions, and wherein said adjusting step adjusts the one or more beam radiation patterns for direction of energy to one or more of said particular directions while avoiding said zones or spans of directions in the three dimensional space, and	The Accused Advanced Antenna Mobile Devices adjust one or more radiation patterns from the steerable antenna to direct energy in zones or spans of directions where obstacles were not detected, while avoiding spans or directions where obstacles were detected. The Qualcomm article "5G Modems, RF and Antennas — Getting mmWave Data into the Device describes the QTM525 mmWave antenna module, included in certain Accused Advanced Antenna Mobile Devices, that allows "[t]he device and the network exchange information constantly, directing beams in a way they can best reach each other." *See* www.qualcomm.com/developer/blog/2019/11/5g-modems-rf-and-antennas-getting-mmwave-data-device In one example, the Qualcomm document below describes that the 5G modem available in certain Accused Advanced Antenna Mobile Devices as capable of avoiding obstructions in a direct line-of-sight transmission paths and selecting indirect transmission paths with lower signal attenuation. See https://www.qualcomm.com/content/dam/qcomm-martech/dm-assets/documents/x50info11.pdf 

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At least by this manner, for example, the Accused Advanced Antenna Mobile Devices adjust the radiation patterns from the steerable antenna to direct energy in spans or directions where obstacles were not detected, while avoiding spans of directions where obstacles were detected.

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The Operational Description describes that the Accused mmWave Product implements beamforming for 5G band n261.

Beamforming – n261

The mmWave operations in this device use beam-forming. The below beams are used in this device (no other beams or combinations of beams are supported.)

	Patch/Dipole	SISO/MIMO & Polarization	Beam ID	
ANT L	Patch	Single beam / V-pole	0	
			1	
			2	
			3	
			4	
			5	
			6	
		Single beam / H-pole		7
				8
				9
				10
				11
				12
				13
		Paired beam / MIMO	0	7
			1	8
			2	9
			3	10
			4	11
			5	12
			6	13

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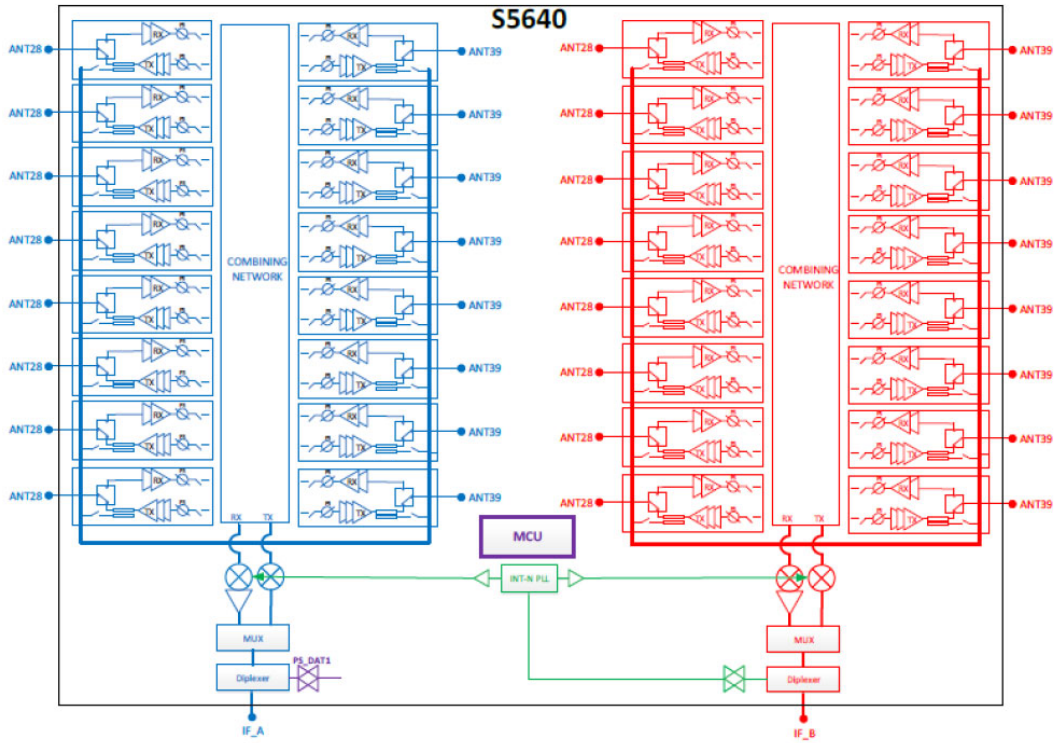
[1D] wherein said at least one steerable antenna operates on one or multiple bands and radiates at one or more frequencies in the range of 10 GHz to 500 GHz.	The steerable antenna arrays in the Accused Advanced Antenna Mobile Devices are for 5G bands operating above 10 GHz and less than 500 GHz. According to the Operational Description, each phase array chip includes 20 antenna ports: 10 for 28 GHz band and 10 for 39 GHZ band.  *See* fcc.report/FCC-ID/A3LSMA536V/5651659.pdf ("Operational Description"). The Operational Description describes that the Accused mmWave Product (e.g., SM-A536V model) implements beamforming for 5G band n261, which has a frequency of 27.5 - 28.35 GHz, which is in the range of 10 GHz to 500 GHz.

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Claim 2	**Accused Advanced Antenna Mobile Devices**
[2] The method of claim 1, wherein said detecting step comprises one or more of: capturing one or more images with at least one camera; detecting ambient light or blockage thereof with at least one light sensor; detecting motion of said wireless device with at least one gyroscope; detecting one or more of audio or ultrasonic signals relating to the orientation of the user or structure with one or more of a microphone, ultrasonic sensor, or ultrasonic transducer; and detecting relative position of the user or structure with at least one capacitive sensor.	The Accused Advanced Antenna Mobile Devices detect an orientation of the wireless device relative to the obstacle at least by detecting ambient light or blockage thereof with at least one light sensor. See claim element [1A] above.
Claim 5	**Accused Advanced Antenna Mobile Devices**
[5] The method of claim 1 wherein said at least one steerable antenna or said another antenna uses one or more of: beamforming, beamsteering, beam or antenna element selection, adaptive	The steerable antenna Accused Advanced Antenna Mobile Devices use at least beamforming and MIMO. *See* Operational Description at p. 38.

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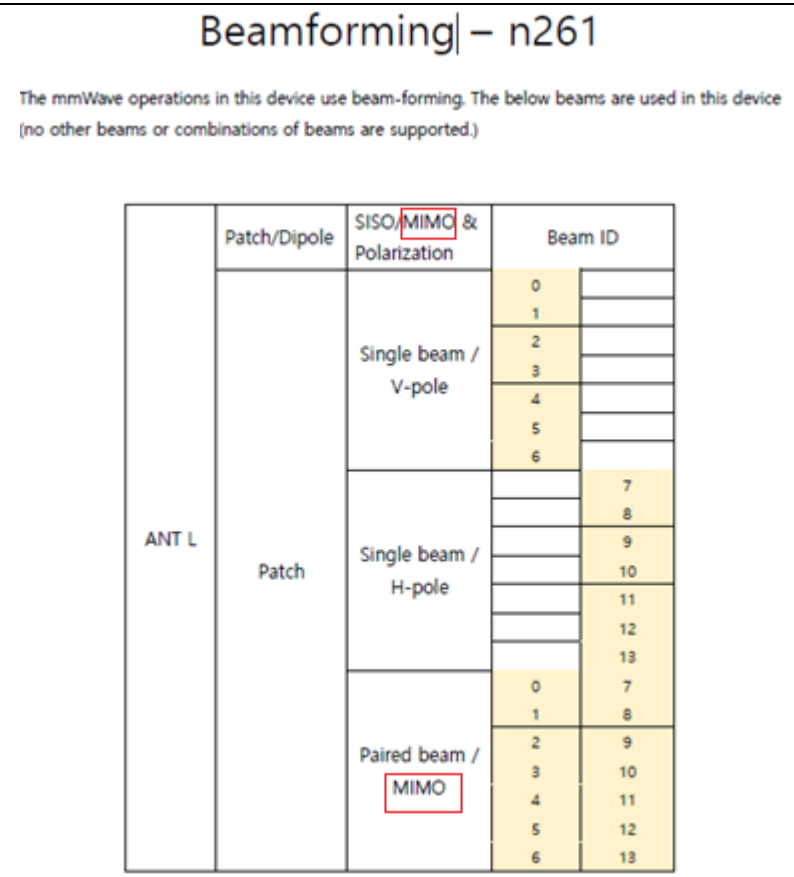
beamforming, multibeam combining, MIMO, phasing, beam switchable array, active combining, passive combining, and hybrid antenna structure.	
Claim 9	**Accused Advanced Antenna Mobile Devices**
[9] The method of claim 1 wherein the at least one steerable antenna operates on multiple bands.	The steerable antenna in the Accused Advanced Antenna Mobile Devices operates on multiple bands, such as the n260 and n261 bands. *See* Operational Description at sheet 32.

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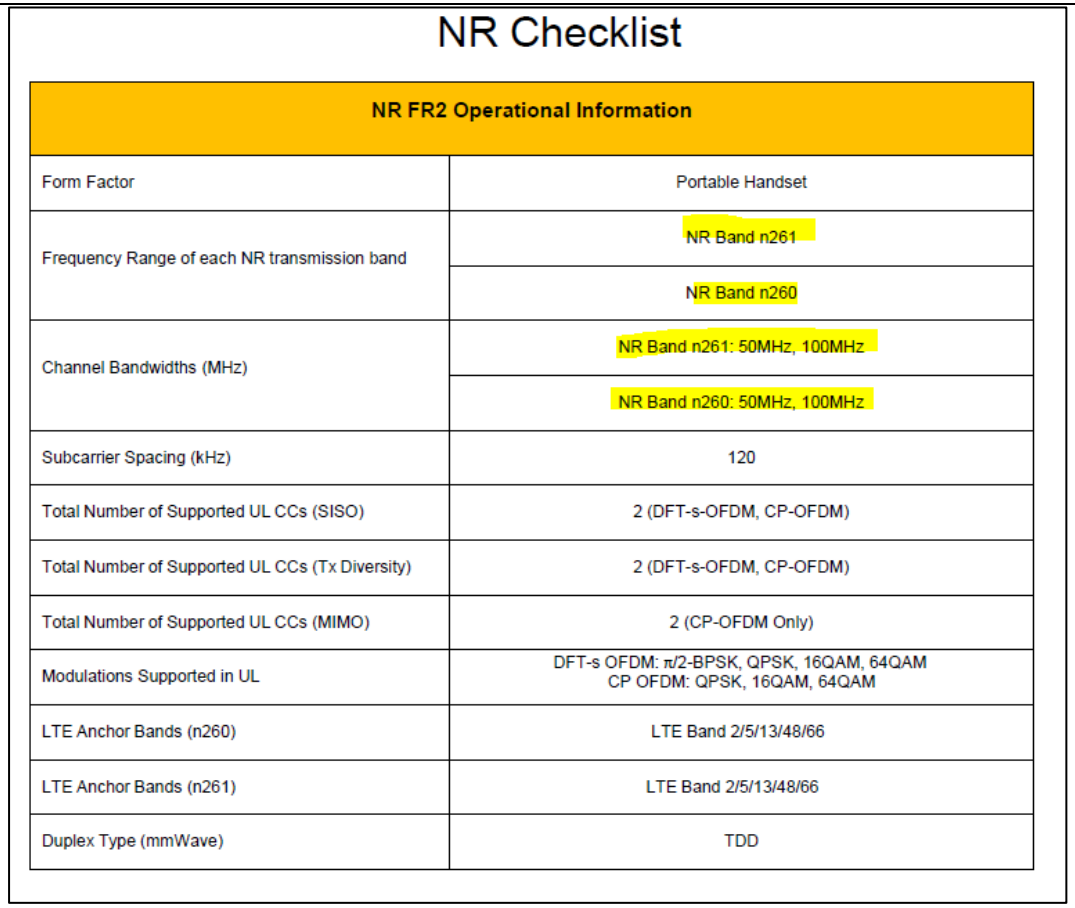

NR Checklist

NR FR2 Operational Information	
Form Factor	Portable Handset
Frequency Range of each NR transmission band	NR Band n261
	NR Band n260
Channel Bandwidths (MHz)	NR Band n261: 50MHz, 100MHz
	NR Band n260: 50MHz, 100MHz
Subcarrier Spacing (kHz)	120
Total Number of Supported UL CCs (SISO)	2 (DFT-s-OFDM, CP-OFDM)
Total Number of Supported UL CCs (Tx Diversity)	2 (DFT-s-OFDM, CP-OFDM)
Total Number of Supported UL CCs (MIMO)	2 (CP-OFDM Only)
Modulations Supported in UL	DFT-s OFDM: π/2-BPSK, QPSK, 16QAM, 64QAM CP OFDM: QPSK, 16QAM, 64QAM
LTE Anchor Bands (n260)	LTE Band 2/5/13/48/66
LTE Anchor Bands (n261)	LTE Band 2/5/13/48/66
Duplex Type (mmWave)	TDD

Claim 11	**Accused Advanced Antenna Mobile Devices**
[11PRE] A wireless device for avoiding radiation of a user or structure, comprising:	The Accused Advanced Antenna Mobile Devices are wireless devices and avoid radiation of a user or structure (e.g., obstacle) as described below. *See* claim elements [11A]-[11J] below.
[1A] one or more sensors selected from the group consisting of	*See* claim element [1A] above.

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<table>
<tr><td>cameras, microphones, audio sensors, ultrasound sensors or transducers, range finders, capacitive sensors, gyroscopes, light detectors, or motion detectors configured to detect in a three dimensional space an orientation of said wireless device relative to either or both said user and said structure;</td><td></td></tr>
<tr><td>[11B] one or more processors communicatively coupled to said one or more sensors;</td><td>The Accused Advanced Antenna Mobile Devices comprise one or more processors communicatively coupled to said one or more sensors.

For example, the table below shows certain Accused Advanced Antenna Mobile Devices comprising a variation of the Qualcomm Snapdragon processors. The Snapdragon processors are coupled to a plurality of sensors including an accelerometer, gyroscope, proximity sensor, infrared light sensor, and ambient light sensor.

<table><tr><td>S20</td><td>S21</td><td>S22</td><td>S23</td><td>S24</td><td>S25</td></tr><tr><td>Snapdragon 865</td><td>Snapdragon 888</td><td>Snapdragon 8 Gen 1</td><td>Snapdragon 8 Gen 2</td><td>Snapdragon 8 Gen 3</td><td>Snapdragon 8 Elite</td></tr></table>
See https://www.phonearena.com/phones/Samsung-Galaxy-S20_id11266

https://www.phonearena.com/phones/Samsung-Galaxy-S21_id11508

https://www.phonearena.com/phones/Samsung-Galaxy-S22_id11763

https://www.phonearena.com/phones/Samsung-Galaxy-S23_id11999

https://www.phonearena.com/phones/Samsung-Galaxy-S24_id12113

https://www.phonearena.com/phones/Samsung-Galaxy-S25_id12340

See also Operation Description at sheet 13:</td></tr>
</table>

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	2.1 AP/CP : S5E8825 (EXYNOS1280) **1) Description** S5E8825 is a System-on-Chip (SoC), which is based on a 64-bit RISC processor. It also contains a 5G communication processor (modem), which is compliant with 5G NR features and all legacy features. S5E8825 targets high-end smart phones and tablet products. S5E8825 is based on the 5 nm low-power process and it provides the following features: ☐ Octa-core CPU (Dual-core ARM Cortex-A78 (Big CPU), and Hexa-cores ARM Cortex-A55 (Little CPU) ☐ 17.1 GB/s of LPDDR4 bandwidth ☐ WQHD embedded display ☐ 4K 30-frame video decoding (H.264/HEVC) and FHD 30-frame video decoding/encoding hardware (MPEG4/H.263/VP8) ☐ 3D graphics H/W ☐ Image Signal Processor (ISP) ☐ Neural Processing Unit (NPU) ☐ ABOX (Audio Sub-System) ☐ High-speed interfaces, such as UFS 2.2 and USB 2.0 DRD ☐ Embedded communication processor (5G NR FR1 FR2, 4G LTE, 3G FDD/TDD, 2G GSM/CDMA) ☐ GNSS and WiFi/BT ☐ Context HUB (CHUB)
[11C] at least one steerable antenna communicatively coupled to said one or more processors wherein said at least one steerable antenna is configured to adjust a beam radiation pattern so as to steer or direct its energy in particular directions while providing nulls or dead zones in other directions, wherein said at least	See claim elements [1C] and [1D] above.

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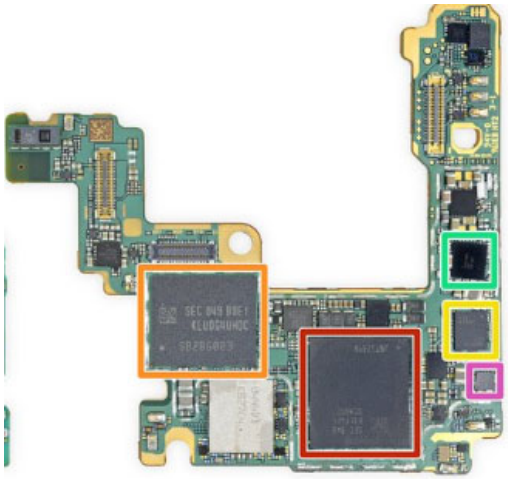
one steerable antenna radiates at one or more frequencies in the range of 10 GHz to 500 GHz; and	
[11D] a non-transitory computer readable medium comprising executable instructions that when executed by said one or more processors cause said one or more processors to perform the steps of:	The Accused Advanced Antenna Mobile Devices comprise one or more processors and a non-transitory readable medium (e.g., memory) that comprises executable instructions that are executed by the one or more processors. For example, the image below shows an Accused Advanced Antenna Mobile Device (e.g., Samsung Galaxy S21) comprising a "Qualcomm Snapdragon 888 layered beneath Samsung K3LK4K40CM-BGCP 12 GB LPDDR5 RAM" by the red rectangle on a printed circuit board. The 12 GB LPDDR5 RAM is one or more memory units that store executable instructions that are executed by the processor.  See https://www.ifixit.com/Teardown/Samsung+Galaxy+S21+Ultra+Teardown/141188
[11E] receiving signals from said one or more sensors pertaining to	The Accused Advanced Antenna Mobile Devices comprise a plurality of sensor including an accelerometers, gyroscopes, and proximity sensors in the form of ambient light sensors and/or

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said orientation in the three dimensional space;	infrared light sensor that can communicate with the processor to determine the relative orientation of the device and three-dimensional spaces.
[11F] using said signals, computing zones or spans of directions corresponding with one or more directions of either or both said user and said structure relative to said at least one steerable antenna in the three dimensional space; and	See claim element [1B] above.
[11G] adjusting one or more beam radiation patterns of said at least one steerable antenna to radiate in one or more directions of said particular directions which are not in said zones or spans of directions in the three dimensional space,	See element [1C] above.
[11H] wherein said at least one steerable antenna radiates said one or more beams based on signals from said one or more processors determined on execution of said executable instructions, and	The Accused Advanced Antenna Mobile Devices comprise at least one steerable antenna that is controlled by a microcontroller unit ("MCU"), as shown in the Operational Description.

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	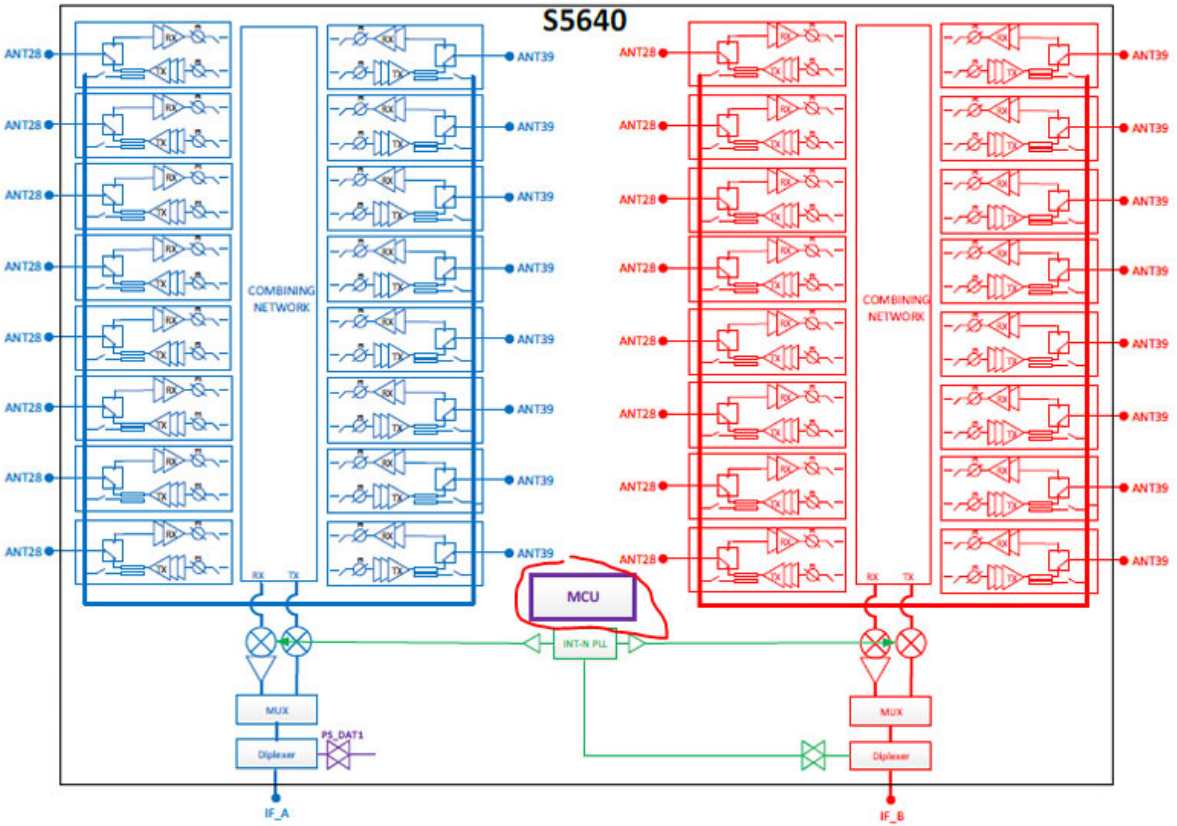 See claim element [11B] above.
[11I] wherein said at least one steerable antenna operates on one or multiple bands; and	See claim [9] above.

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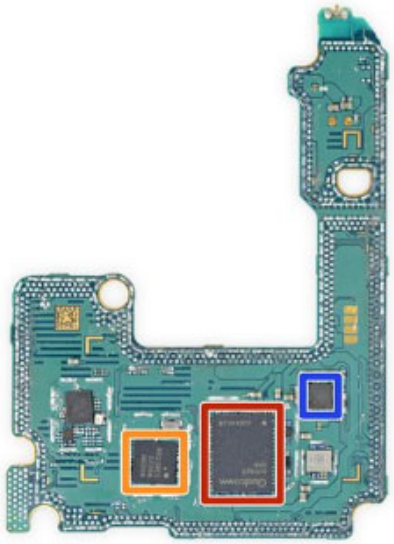
[11J] a receiver for receiving over-the-air signals.	The Accused Advanced Antenna Mobile Devices comprise a receiver for receiving over-the-air signals. For example, the image below shows an Accused Advanced Antenna Mobile Device (e.g., Samsung Galaxy S21) comprising a "Qualcomm SDR868 RF transceiver" by the red rectangle on a printed circuit board. The SDR868 RF transceiver is configured to receive over-the-air signals in communication with the antenna modules.  See https://www.ifixit.com/Teardown/Samsung+Galaxy+S21+Ultra+Teardown/141188 See Operational Description at sheet 10:

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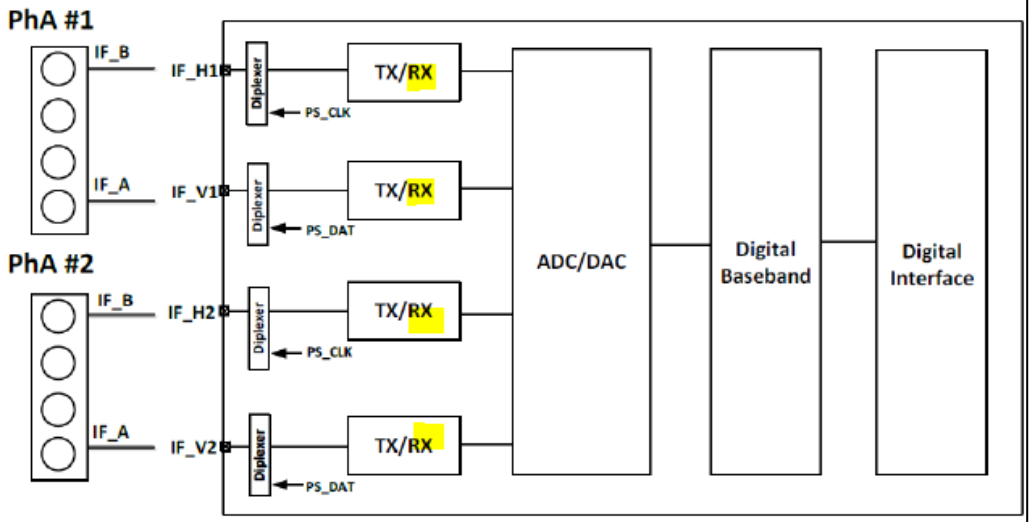
	1.10.2 Chip Block Diagram The block diagram shows the S5720 internal architecture. It has four IF ports that can connect to two phased array chips, providing two independent IF paths for each, indicated by IF_H and IF_V in the figure. Each IF_V and IF_H pair uses the same LO frequency, but the LO frequency of the two pairs can be different. The chip has four receiver (Rx) and four transmitter (Tx) chains. The transmitter chain filters the analog baseband signal coming from the DAC, up-converts it to 9GHz IF with its IQ modulator, and drives it to the RF output through the driver amplifier (DA) and the T/R switch. In the receiver mode, the IF input coming from the phased array chip passes through the diplexer and T/R switch, and gets amplified (if necessary) and then down-converted to the base band using IQ demodulators. The signal is then filtered by low-pass filters in the base band, and sent to ADCs. S5720 controls the phased array modules via PSpeedy interface. PSpeedy requires two signals: reference clock at ~560 MHz, PS_CLK, and control data, PS_DAT at 140MHz. On the IF_H, a diplexer is used to combine 9-GHz IF_H with PS_CLK so that they can be multiplexed over one signal line. Similarly, another diplexer is used on IF_V to combine the IF signal and PS_DAT. PS_CLK is also used as reference clock for PLL in the phased array chip. 
Claim 12	**Accused Advanced Antenna Mobile Devices**

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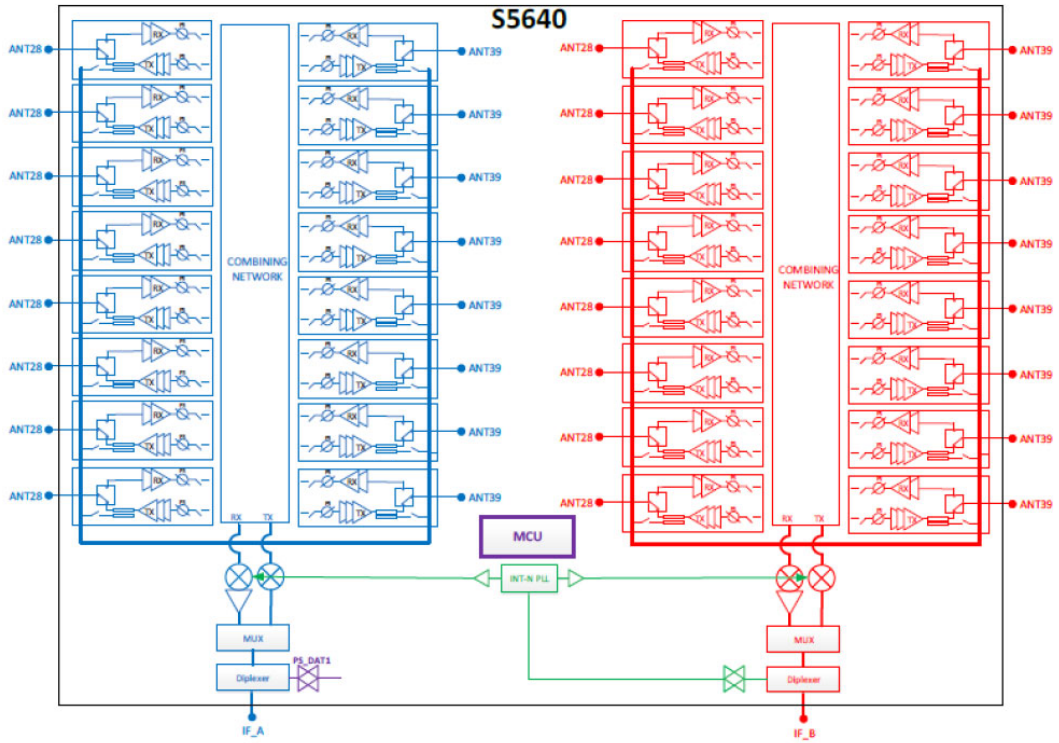
[12] The wireless device of claim 11, wherein said at least one steerable antenna comprises a plurality of steerable antennas.	According to the Operational Description, the Accused Advanced Antenna Mobile Device includes a "mmW Antenna Module," which includes "two separate phased array chips (S5640)." Each phase array chip includes 20 antenna ports: 10 for 28 GHz band and 10 for 39 GHZ band. 
Claim 13	**Accused Advanced Antenna Mobile Devices**
[13] The wireless device of claim 11, wherein said one or more sensors includes one or more cameras, gyroscopes, light or motion detectors, capacitive	The Accused Advanced Antenna Mobile Devices include at least light detectors. See claim element [1A] above.

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sensors, microphones, and ultrasound sensors or transducers.	
Claim 17	**Accused Advanced Antenna Mobile Devices**
[17] The wireless device of claim 11 wherein said at least one steerable antenna or said receiver uses one or more of: beamforming, beamsteering, beam or antenna element selection, adaptive beamforming, multibeam combining, MIMO, phasing, beam switchable array, active combining, passive combining, and hybrid antenna structure.	See claim [5] above.
Claim 21	**Accused Advanced Antenna Mobile Devices**
[21] The wireless device of claim 11 wherein the at least one steerable antenna operates on multiple bands.	See claim [9] above.
Claim 23	**Accused Advanced Antenna Mobile Devices**
[23PRE] A steerable antenna system for avoiding radiation of a user or structure by a wireless device, comprising:	See claim element [11PRE] above.
[23A] one or more sensors configured to detect in a three dimensional space using one or	See claim element [11A] above.

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more cameras, microphones, audio sensors or transducers, ultrasound sensors, range finders, capacitive sensors, gyroscopes, light detectors, or motion detectors, an orientation of said wireless device relative to either or both said user and said structure;	
[23B] a computation module communicatively coupled to said one or more sensors configured to determine zones or spans of directions;	See claim element [11B] above.
[23C] at least one steerable antenna that radiates at one or more frequencies in the range of 10 GHz to 500 GHz communicatively coupled to said computation module, said at least one steerable antenna being configured for adjustably radiating one or more beams in one or more directions which are not in said zones or spans of directions in the three dimensional space,	See claim element [11C] above.
[23D] wherein said zones or spans of directions correspond with one or more directions of said user or structure relative to said at least	See claim element [11F] above.

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one steerable antenna in the three dimensional space,	
[23E] wherein said at least one steerable antenna is configured to adjustably steer or direct its energy in particular directions while providing nulls or dead zones in other directions in the three dimensional space,	See claim element [11G] above.
[23F] wherein said at least one steerable antenna operates on one or multiple bands; and	See claim element [11H] above.
[23G] a receiver for receiving signals.	See claim element [11J] above.